AMENDMENTS TO THE CLAIMS

Claim 1 (Original): An apparatus for storing data, said apparatus comprising:

a fixed electrode electrically coupled to

a storage medium having a multiplicity of different and distinguishable oxidation states wherein data is stored in said oxidation states by the addition or withdrawal of one or more electrons from said storage medium via the electrically coupled electrode; wherein said storage medium comprises a molecule attached to said electrode through a linker selected from the group consisting of the linker component of molecules "A" through "I" of figure 34.

Claim 2 (Original): The apparatus of claim 1, wherein said storage medium stores data at a density of at least one bit per molecule.

Claim 3 (Original): The apparatus of claim 1, wherein said storage medium comprises a molecule having at least two different and distinguishable oxidation states.

Claim 4 (Original): The apparatus of claim 1, wherein said storage medium comprises a molecule having at least eight different and distinguishable oxidation states.

Claim 5 (Original): The apparatus of claim 1, wherein said storage medium is covalently linked to said electrode.

Claim 6 (Original): The apparatus of claim 1, wherein said storage medium is electrically coupled to said electrode through a linker.

Claim 7 (Original): The apparatus of claim 1, wherein said storage medium is covalently linked to said electrode through a linker.

Claim 8 (Original): The apparatus of claim 7, wherein said linker is a thiol linker.

Claim 9 (Original): The apparatus of claim 1, wherein said storage medium is juxtaposed in the proximity of said electrode such that electrons can pass from said storage medium to said electrode.

Claim 10 (Original): The apparatus of claim 1, wherein said storage medium is juxtaposed to a dielectric material imbedded with counterions.

Claim 11 (Original): The apparatus of claim 1, wherein said storage medium and said electrode are fully encapsulated in an integrated circuit.

Claim 12 (Original): The apparatus of claim 1, wherein said storage medium is electronically coupled to a second fixed electrode that is a reference electrode.

Claim 13 (Original): The apparatus of claim 1, wherein said storage medium is present on a single plane in said device.

Claim 14 (Original): The apparatus of claim 1, wherein said storage medium is present at a multiplicity of storage locations.

Claim 15 (Original): The apparatus of claim 14, wherein said storage locations are present on a single plane in said device.

Claim 16 (Original): The apparatus of claim 14, wherein said apparatus comprises multiple planes and said storage locations are present on multiple planes of said device.

Claim 17 (Original): The apparatus of claim 14, wherein said storage locations range from about 1024 to about 4096 different locations.

Claim 18 (Original): The apparatus of claim 17, wherein each location is addressed by a single electrode.

Claim 19 (Original): The apparatus of claim 17, wherein each location is addressed by two electrodes.

Claim 20 (Original): The apparatus of claim 1, wherein said electrode is connected to a voltage source.

Claim 21 (Original): The apparatus of claim 20, wherein said voltage source is the output of an integrated circuit.

Claim 22 (Original): The apparatus of claim 1, wherein said electrode is connected to a device to read the oxidation state of said storage medium.

Claim 23 (Original): The apparatus of claim 22, wherein said device is selected from the group consisting of a voltammetric device, an amperometric device, and a potentiometric device.

Claim 24 (Original): The apparatus of claim 23, wherein said device is an impedance spectrometer or a sinusoidal voltammeter.

Claim 25 (Original): The apparatus of claim 22, wherein said device provides a Fourier transform of the output signal from said electrode.

Claim 26 (Original): The apparatus of claim 22, wherein said device refreshes the oxidation state of said storage medium after reading said oxidation state.

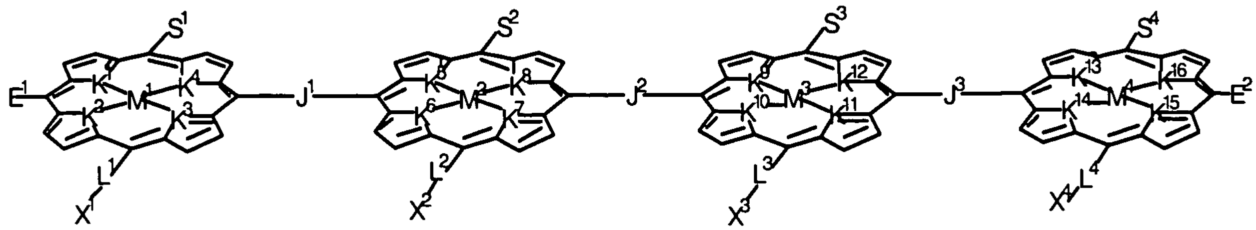
Claim 27 (Original): The apparatus of claim 1, wherein said different and distinguishable oxidation states of said storage medium can be set by a voltage difference no greater than about 2 volts.

Claim 28 (Original): The apparatus of claim 1, wherein said storage medium is selected from the group consisting of a porphyrinic macrocycle, a metallocene, a linear polyene, a cyclic polyene, a heteroatom-substituted linear polyene, a heteroatom-substituted cyclic polyene, a tetrathiafulvalene, a tetraselenafulvalene, a metal coordination complex, a buckyball, a triarylamine, a 1,4-phenylenediamine, a xanthene, a flavin, a phenazine, a phenothiazine, an acridine, a quinoline, a 2,2'-bipyridyl, a 4,4'-bipyridyl, a tetrathiotetracene, and a *peri*-bridged naphthalene dichalcogenide.

Claim 29 (Original): The apparatus of claim 28, wherein said storage medium comprises a molecule selected from the group consisting of a porphyrin, an expanded porphyrin, a contracted porphyrin, a ferrocene, a linear porphyrin polymer, and a porphyrin array.

Claim 30 (Original): The apparatus of claim 29, wherein said storage medium comprises a porphyrinic macrocycle substituted at a β- position or at a *meso-* position.

Claim 31 (Original): The apparatus of claim 29, wherein said storage medium comprises a molecule having the formula:



wherein

S^1, S^2, S^3, and S^4 are substituents independently selected from the group consisting of aryl, phenyl, cycloalkyl, alkyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, and carbamoyl wherein said substituents provide a redox potential range of less than about 2 volts;

M^1, M^2, M^3, and M^4 are independently selected metals;

K^1, K^2, K^3, K^4, K^5, K^6, K^7, K^8, K^9, K^{10}, K^{11}, K^{12}, K^{13}, K^{14}, K^{15}, and K^{16} are independently selected from the group consisting of N, O, S, Se, Te, and CH;

J^1, J^2, and J^3 are independently selected linkers;

L^1, L^2, L^3, and L^4 are present or absent and, when present are independently selected linkers;

X^1, X^2, X^3, and X^4 are independently selected from the group consisting of a substrate, a reactive site that can covalently couple to a substrate, and a reactive site that can ionically couple to a substrate;

and E^1 and E^2 are terminating substituents selected from the group consisting of aryl, phenyl, cycloalkyl, alkyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, and carbamoyl wherein said substituents provide a redox potential range of less than about 2 volts; and

said molecule has at least two different and distinguishable oxidation states.

Claim 32 (Original): The apparatus of claim 31, wherein said molecule has at least eight different and distinguishable oxidation states.

Claim 33 (Original): The apparatus of claim 31, wherein M^1, M^2, M^3, and M^4 are independently selected from the group consisting of Zn, Mg, Cd, Hg, Cu, Ag, Au, Ni, Pd, Pt, Co, Rh, Ir, Mn, B, Al, Ga, Pb, and Sn.

Claim 34 (Original): The apparatus of claim 31, wherein J^1, J^2, and J^3 are independently selected from the group consisting of 4,4'-diphenylethyne, 4,4'-diphenylbutadiyne, 4,4'-biphenyl, 1,4-phenylene, 4,4'-stilbene, 1,4-bicyclooctane, 4,4'-azobenzene, 4,4'-benzylideneaniline, and 4,4"-terphenyl.

Claim 35 (Original): The apparatus of claim 31, wherein L^1-X^1, L^2-X^2, L^3-X^3, and L^4-X^4 are independently present or absent and, when present, are independently selected from the group consisting of 4-(2-(4-mercaptophenyl)ethynyl)phenyl, 4-mercaptomethylphenyl, 4-hydroselenophenyl, 4-(2-(4-hydroselenophenyl)ethynyl)phenyl, 4-hydrotellurophenyl, and 4-(2-(4-hydrotellurophenyl)ethynyl)phenyl.

Claim 36 (Original): The apparatus of claim 32, wherein

K^1, K^2, K^3, K^4, K^5, K^6, K^7, K^8, K^9, K^{10}, K^{11}, K^{12}, K^{13}, K^{14}, K^{15}, and K^{16} are the same;

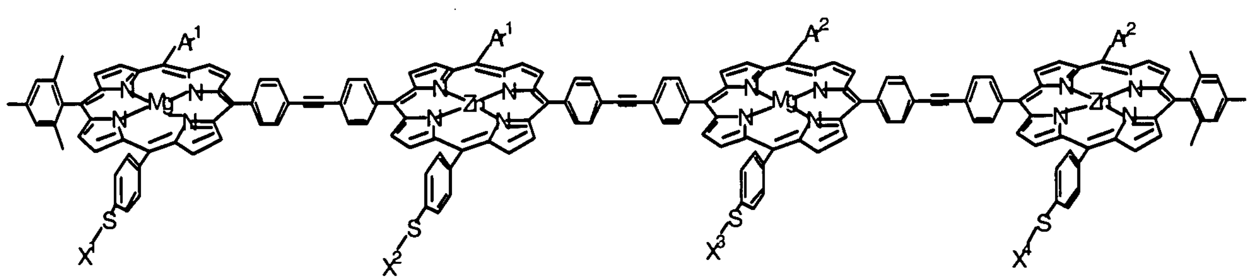
M^1 and M^3 are the same;

M^2 and M^4 are the same and different from M^1 and M^3;

S^1 and S^2 are the same; and

S^3 and S^4 are the same and different from S^1 and S^2.

Claim 37 (Original): The apparatus of claim 31, wherein said apparatus comprises a molecule having the formula:



wherein

Ar^1 and Ar^2 are independently aromatic groups; and

X^1, X^2, X^3, and X^4 are independently selected from the group consisting of H or a substrate.

Claim 38 (Original): The apparatus of claim 31, wherein said storage medium comprises a porphyrinic macrocycle containing at least two porphyrins of equal energies held apart from each other at a spacing less than about 50 Å such that said molecule has an odd hole oxidation state permitting the hole to hop between said two porphyrins and wherein said odd hole oxidation state is different from and distinguishable from another oxidation state of said porphyrinic macrocycle.

Claim 39 (Original): The apparatus of claim 29, wherein said storage medium comprises a molecule having the formula:

$$
\begin{array}{ccccc}
P^1 & & & & P^4 \\
| & & & & | \\
J^1 & & & & J^3 \\
| & & & & | \\
P^2 & — & Q & — & P^5 \\
| & & & & | \\
J^2 & & & & J^4 \\
| & & & & | \\
P^3 & & & & P^6
\end{array}
$$

wherein:

J^1, J^2, J^3, and J^4 are independently selected linkers that permit electron transfer between the porphyrinic macrocycles;

P^1 and P^2 are porphyrinic macrocycles selected to have the same oxidation state;

P^4 and P^6 are porphyrinic macrocycles selected to have the same oxidation state;

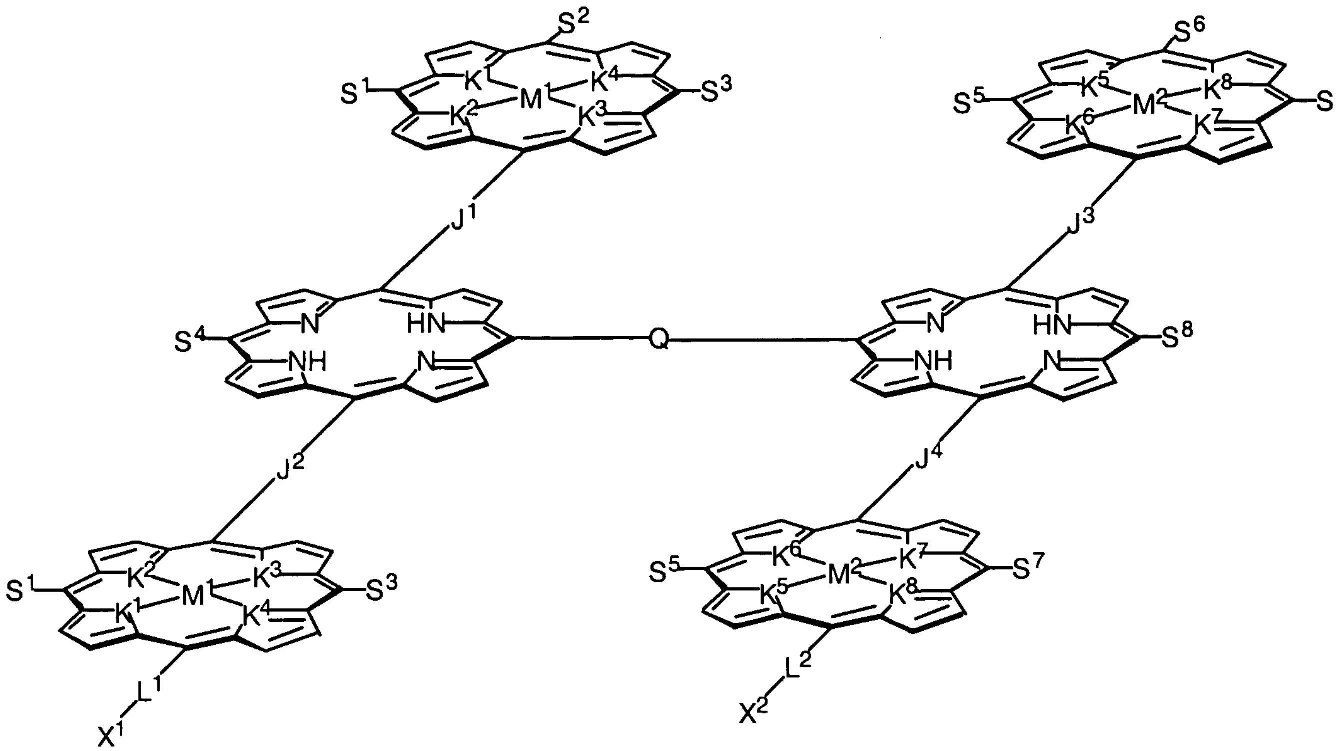
P^2 has an oxidation potential greater than the oxidation potential of P^1 or P^3;

P^5 has an oxidation potential greater than the oxidation potential of P^4 or P^6; and

Q is a linker.

Claim 40 (Original): The apparatus of claim 39, wherein Q is selected from the group consisting of 1,4-bis(4-terphen-4"-yl)butadiyne or a tetrakis(arylethyne), a linker comprising 1,12-carboranyl ($C_2B_{10}H_{12}$), 1,10-carboranyl ($C_2B_8H_{10}$), [*n*]staffane, 1,4-cubanediyl, 1,4-bicyclo[2.2.2]octanediyl, phenylethynyl, and a linker comprising a *p*-phenylene unit.

Claim 41 (Original): The apparatus of claim 39, wherein said storage medium comprises a molecule having the formula:



wherein

M^1 and M^2 are independently selected metals;

S^1, S^2, S^3, S^4, S^5, S^6, S^7, and S^8 are independently selected from the group consisting of aryl, phenyl, cycloalkyl, alkyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, and carbamoyl;

K^1, K^2, K^3, K^4, K^5, K^6, K^7, and K^8 are independently selected from the group consisting of are independently selected from the group consisting of N, O, S, Se, Te, and CH;

L^1 and L^2 are independently selected linkers; and

X^1 and X^2 are independently selected from the group consisting of a substrate, a reactive site that can covalently couple to a substrate, and a reactive site that can ionically couple to a substrate.

Claim 42 (Original): The apparatus of claim 41, wherein

S^1, S^2, S^3, S^5, S^6, and S^7 are the same;

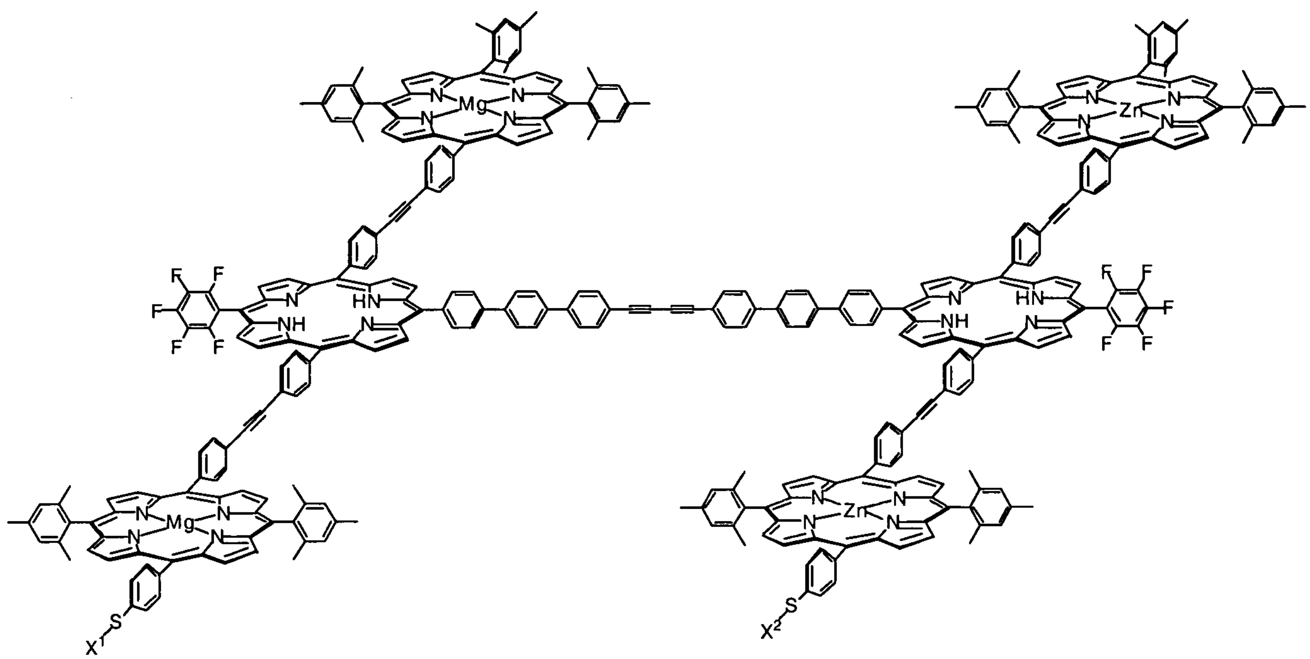
S^4 and S^8 are the same;

K^1, K^2, K^3, K^4, K^5, K^6, K^7, and K^8 are the same

J^1, J^2, J^3 and J^4 are the same; and

M^1 and M^2 are different.

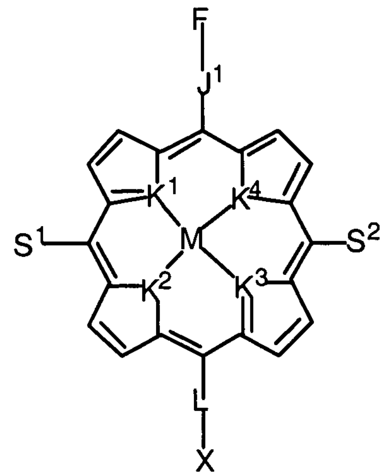
Claim 43 (Original): The apparatus of claim 42, wherein said storage medium comprises a molecule having the formula:



wherein X^1 and X^2 are independently selected from the group consisting of H and a substrate.

Claim 44 (Original): The apparatus of claim 29, wherein said storage medium comprises a molecule having three different and distinguishable oxidation states.

Claim 45 (Previously presented): The apparatus of claim 44, wherein said molecule has the formula:



wherein

F is selected from the group consisting of a ferrocene, a substituted ferrocene, a metalloporphyrin, and a metallochlorin;

J^1 is a linker;

M is a metal;

S^1 and S^2 are independently selected from the group consisting of aryl, phenyl, cycloalkyl, alkyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, and carbamoyl wherein said substituents provide a redox potential range of less than about 2 volts

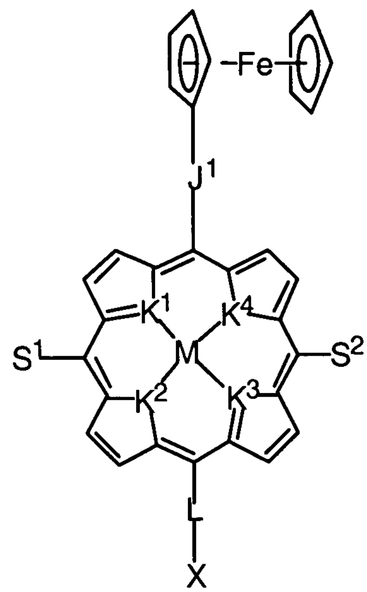
K^1, K^2, K^3, and K^4 are independently selected from the group consisting of N, S, O, Se, Te, and CH;

L is a linker;

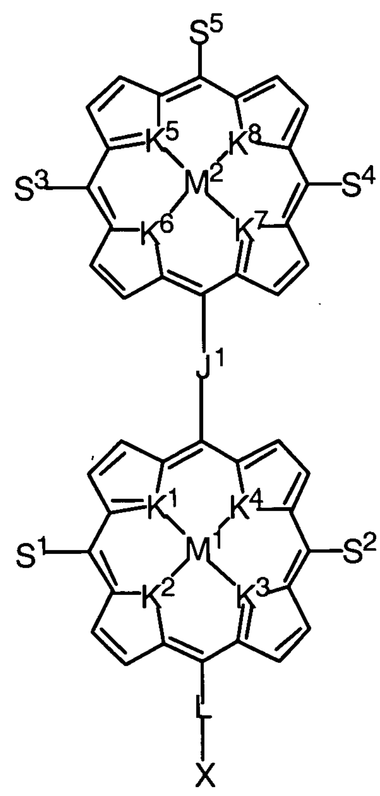
X is selected from the group consisting of a substrate, a reactive site that can covalently couple to a substrate, and a reactive site that can ionically couple to a substrate;

and said molecule has at least three different and distinguishable oxidation states.

Claim 46 (Original): The apparatus of claim 45, wherein said molecule has the formula:



Claim 47 (Original): The apparatus of claim 45, wherein said molecule has the formula:



wherein

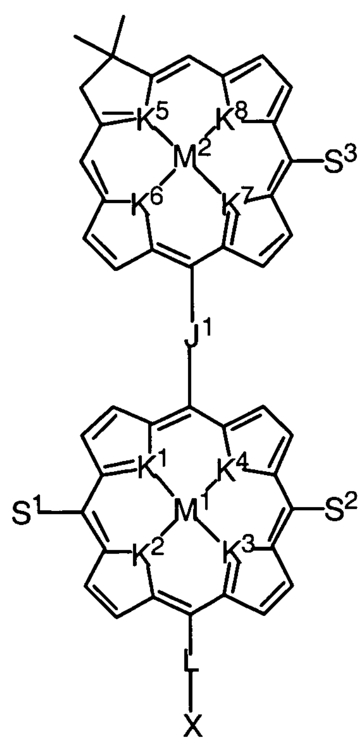
M^2 is a metal;

K^5, K^6, K^7, and K^8 are independently selected from the group consisting of N, S, O, Se, Te, and CH;

S^3, S^4, and S^5 are independently selected from the group consisting of aryl, phenyl, cycloalkyl, alkyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, and carbamoyl wherein said substituents provide a redox potential range of less than about 2 volts; and

L-X is selected from the group consisting of 4-(2-(4-mercaptophenyl)ethynyl)phenyl, 4-mercaptomethylphenyl, 4-hydroselenophenyl, 4-(2-(4-hydroselenophenyl)ethynyl)phenyl, 4-hydrotellurophenyl, and 4-(2-(4-hydrotellurophenyl)ethynyl)phenyl.

Claim 48 (Original): The apparatus of claim 45, wherein said molecule has the formula:



wherein

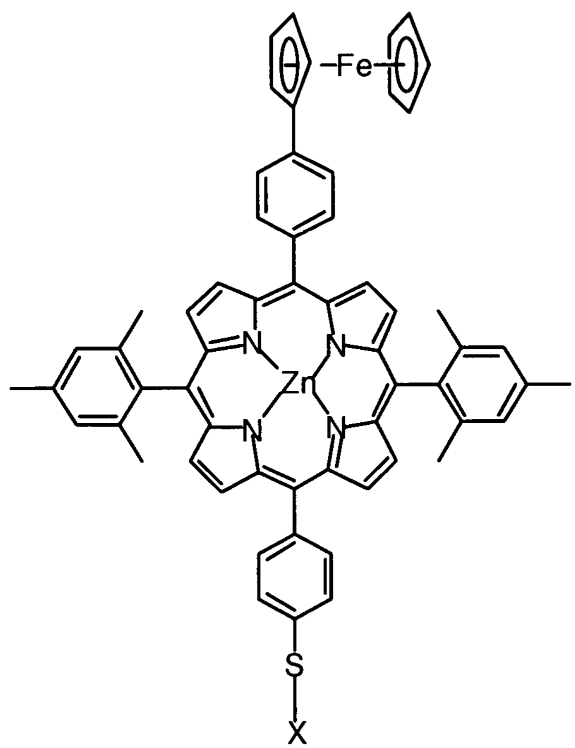
M^2 is a metal;

K^5, K^6, K^7, and K^8 are independently selected from the group consisting of N, O, S, Se, Te, and CH;

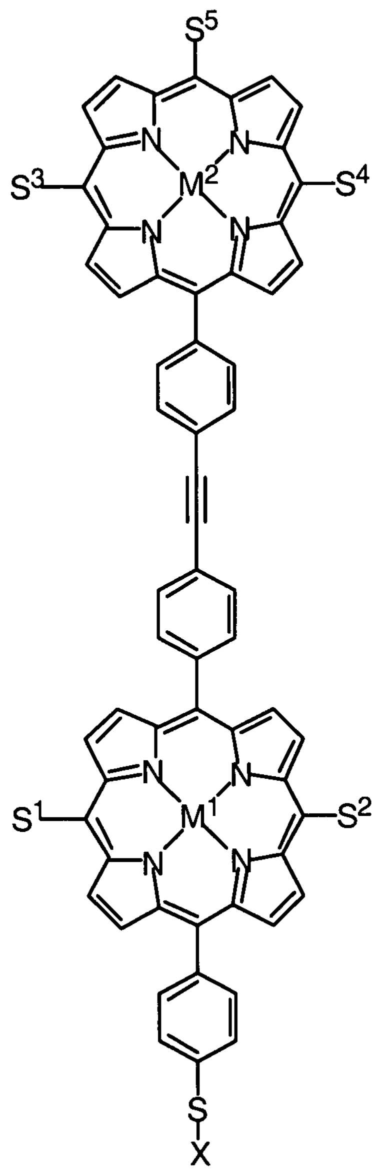
S^3 is selected from the group consisting of aryl, phenyl, cycloalkyl, alkyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, and carbamoyl wherein said substituents provide a redox potential range of less than about 2 volts and

L-X is selected from the group consisting of 4-(2-(4-mercaptophenyl)ethynyl)phenyl, 4-mercaptomethylphenyl, 4-hydroselenophenyl, 4-(2-(4-hydroselenophenyl)ethynyl)phenyl, 4-hydrotellurophenyl, and 4-(2-(4-hydrotellurophenyl)ethynyl)phenyl.

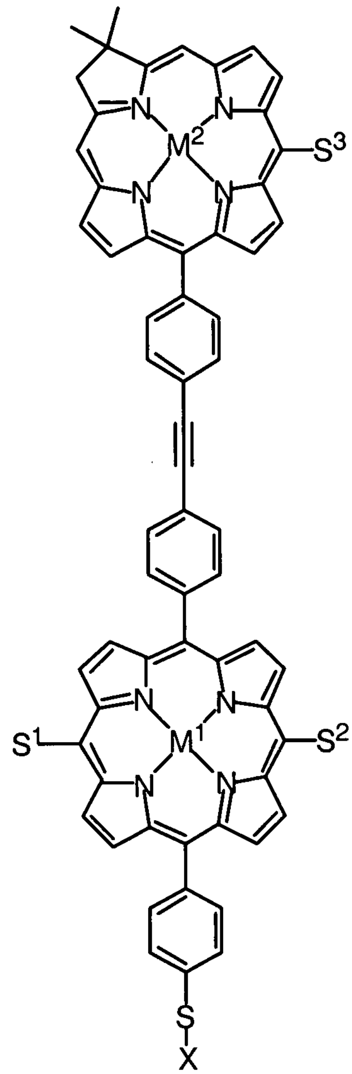
Claim 49 (Original): The apparatus of claim 46, wherein said molecule is



Claim 50 (Original): The apparatus of claim 47, wherein said molecule is

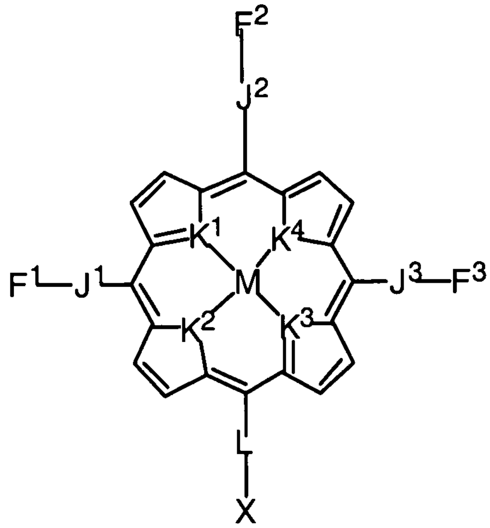


Claim 51 (Original): The apparatus of claim 48, wherein said molecule is



Claim 52 (Original): The apparatus of claim 29, wherein said storage medium comprises a molecule having five different and distinguishable oxidation states.

Claim 53 (Original): The apparatus of claim 52, wherein said molecule has the formula:



wherein

M^1 is a metal;

F^1, F^2, and F^3 are independently selected ferrocenes or substituted ferrocenes;

J^1, J^2, and J^3 are independently selected linkers;

K^1, K^2, K^3, and K^4 are independently selected from the group consisting of N, O, S, Se, Te, and CH;

L is a linker; and

X is selected from the group consisting of a substrate, a reactive site that can covalently couple to a substrate, and a reactive site that can ionically couple to a substrate.

Claim 54 (Original): The apparatus of claim 53, wherein

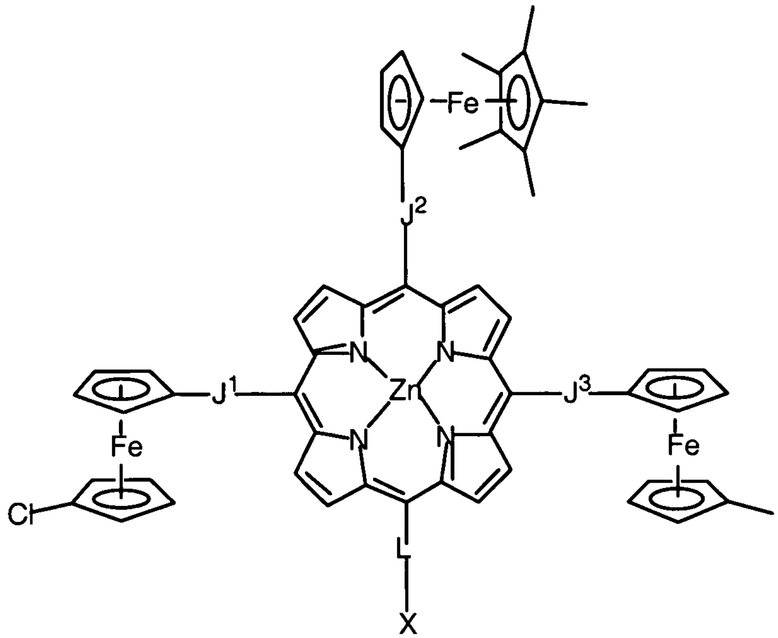
K^1, K^2, K^3 and K^4 are the same;

M^1 is a metal selected from the group consisting of Zn, Mg, Cd, Hg, Cu, Ag, Au, Ni, Pd, Pt, Co, Rh, Ir, Mn, B, Pb, Al, Ga, and Sn;

J^2, J^2, and J^3 are the same; and

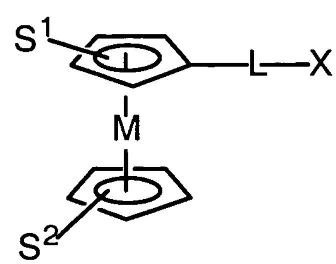
F^1, F^2, and F^3 are all different.

Claim 55 (Original): The apparatus of claim 54, wherein said molecule is



Claim 56 (Original): The apparatus of claim 45, wherein J^1, J^2, and J^3 are selected from the group consisting of 4,4'-diphenylethyne, 4,4'-diphenylbutadiyne, 4,4'-biphenyl, 1,4-phenylene, 4,4'-stilbene, 1,4-bicyclooctane, 4,4'-azobenzene, 4,4'-benzylideneaniline, and 4,4"-terphenyl.

Claim 57 (Original): The apparatus of claim 29, wherein said storage medium comprises a molecule having the formula:



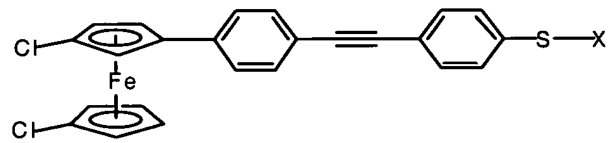
wherein L is a linker;

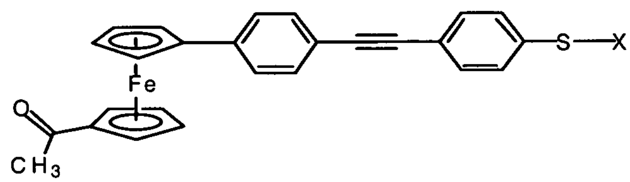
M is a metal;

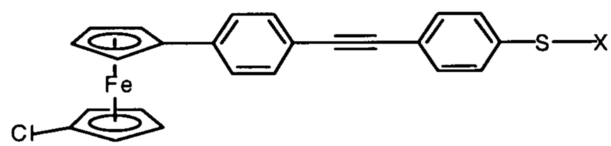
S^1 and S^2 are independently selected from the group consisting of aryl, phenyl, cycloalkyl, alkyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, and carbamoyl wherein said substituents provide a redox potential range of less than about 2 volts; and

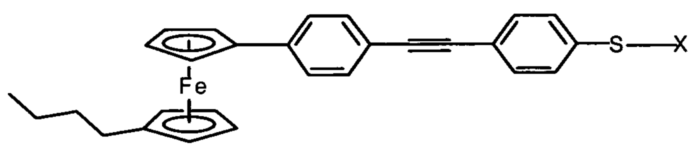
X is selected from the group consisting of a substrate, a reactive site that can covalently couple to a substrate, and a reactive site that can ionically couple to a substrate.

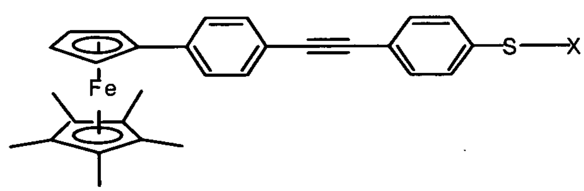
Claim 58 (Original): The apparatus of claim 57, wherein said molecule is selected from the group consisting of:

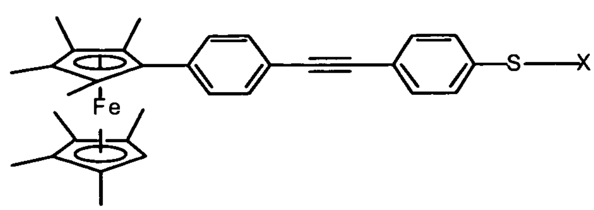










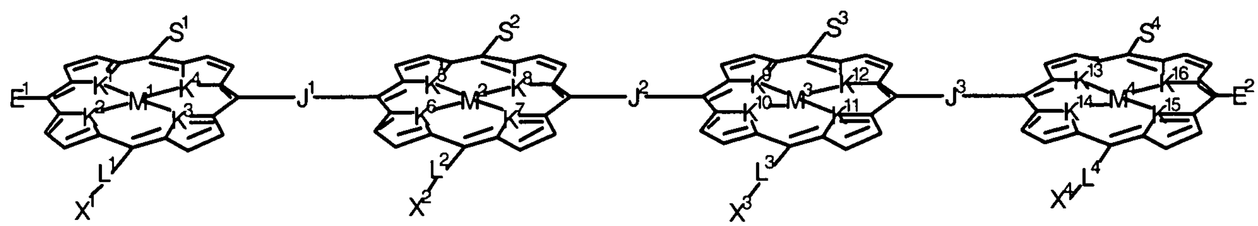


wherein X is a substrate.

Claim 59 (Original): The apparatus of claim 57, wherein -L-X is selected from the group consisting of 4-(2-(4-mercaptophenyl)ethynyl)phenyl, 4-mercaptomethylphenyl, 4-hydroselenophenyl, 4-(2-(4-hydroselenophenyl)ethynyl)phenyl, 4-hydrotellurophenyl, and 4-(2-(4-hydrotellurophenyl)ethynyl)phenyl.

Claims 60-93 (Canceled).

Claim 94 (Original): A molecule for the storage of information, said molecule having the formula:



wherein

S^1, S^2, S^3, and S^4 are substituents independently selected from the group consisting of aryl, phenyl, cycloalkyl, alkyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, and carbamoyl wherein said substituents provide a redox potential range of less than about 2 volts;

M^1, M^2, M^3, and M^4 are independently selected metals;

K^1, K^2, K^3, K^4, K^5, K^6, K^7, K^8, K^9, K^{10}, K^{11}, K^{12}, K^{13}, K^{14}, K^{15}, and K^{16} are independently selected from the group consisting of N, O, S, Se, Te, and CH;

J^1, J^2, and J^3 are independently selected linkers;

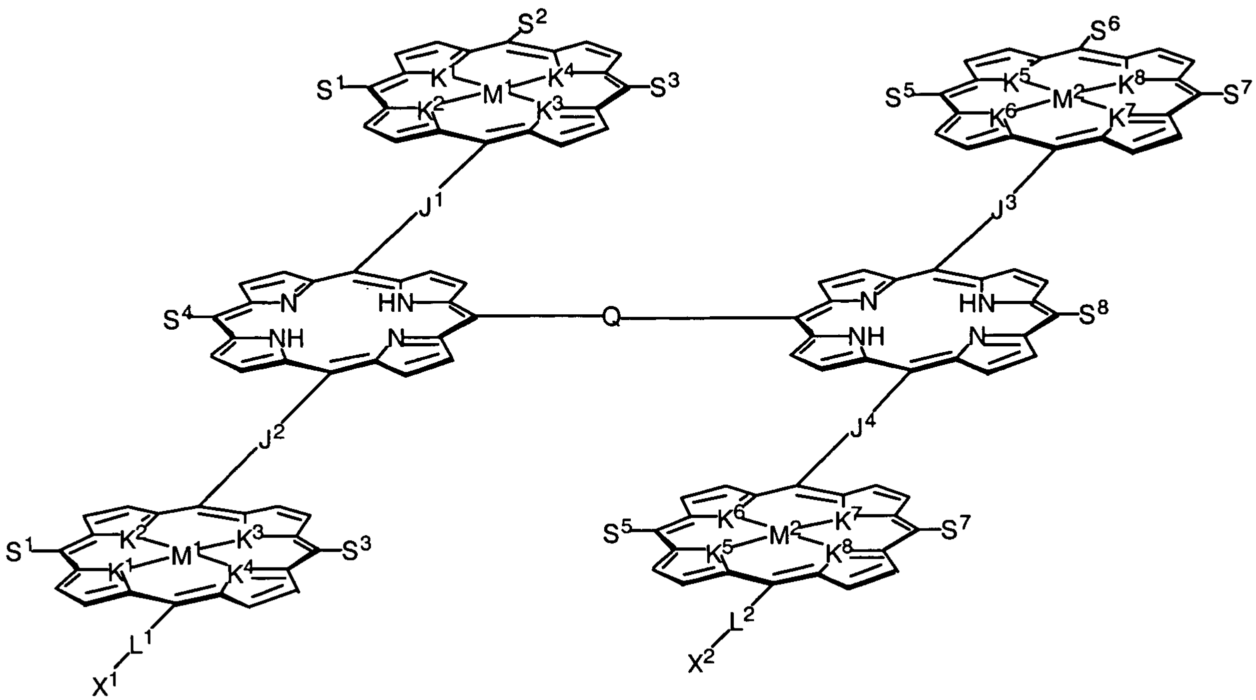
L^1, L^2, L^3, and L^4 are present or absent and, when present are independently selected linkers at least one of which is selected from the group consisting of the linker component of molecules "A" through "I" of figure 34;

and X^1, X^2, X^3, and X^4 are independently selected from the group consisting of a substrate, a reactive site that can covalently couple to a substrate, and a reactive site that can ionically couple to a substrate;

and E^1 and E^2 are terminating substituents; and

said molecule has at least two different and distinguishable oxidation states.

Claim 95 (Original): A molecule for the storage of information, said molecule having the formula:



wherein

M^1 and M^2 are independently selected metals;

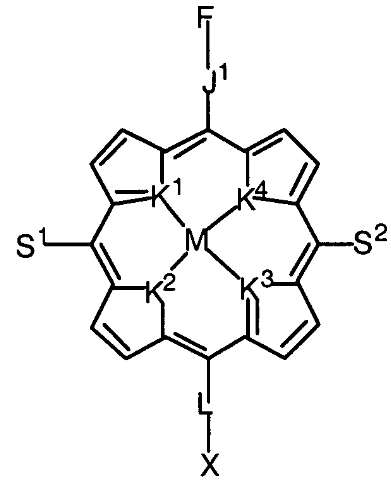
S^1, S^2, S^3, S^4, S^5, S^6, S^7, and S^8 are independently selected from the group consisting of aryl, phenyl, cycloalkyl, alkyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, and carbamoyl;

K^1, K^2, K^3, K^4, K^5, K^6, K^7, and K^8 are independently selected from the group consisting of are independently selected from the group consisting of N, O, S, Se, Te, and CH;

L^1 and L^2 are independently selected linkers; and

X^1 and X^2 are independently selected from the group consisting of a substrate, a reactive site that can covalently couple to a substrate, and a reactive site that can ionically couple to a substrate.

Claim 96 (Original): A molecule for the storage of information, said molecule having the formula:



wherein

F^1 is selected from the group consisting of a ferrocene, a substituted ferrocene, a metalloporphyrin, and a metallochlorin;

J^1 is a linker;

M is a metal;

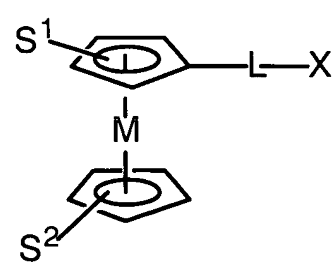
S^1 and S^2 are substituents independently selected from the group consisting of aryl, phenyl, cycloalkyl, alkyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, and carbamoyl wherein said substituents provide a redox potential range of less than about 2 volts;

K^1, K^2, K^3, and K^4 are independently selected from the group consisting of N, O, S, Se, Te, and CH;

L is a linker; and

X is selected from the group consisting of a substrate, a reactive site that can covalently couple to a substrate, and a reactive site that can ionically couple to a substrate, and said molecule has at least three different and distinguishable oxidation states.

Claim 97 (Original): A molecule for the storage of information, said molecule having the formula:



wherein M is a metal;

S^1 and S^2 are selected from the group consisting of aryl, phenyl, cycloalkyl, alkyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, and carbamoyl wherein said substituents provide a redox potential range of less than about 2 volts:

L is a linker; and

X is selected from the group consisting of a substrate, a reactive site that can covalently couple to a substrate, and a reactive site that can ionically couple to a substrate.

Claim 98 (Original): A method of storing data, said method comprising:

i) providing an apparatus according to claim 1; and

ii) applying a voltage to said electrode at sufficient current to set an oxidation state of said storage medium.

Claim 99 (Original): The method of claim 98, wherein said voltage ranges up to about 2 volts.

Claim 100 (Original): The method of claim 98, wherein said voltage is the output of an integrated circuit.

Claim 101 (Original): The method of claim 98, wherein said voltage is the output of a logic gate.

Claim 102 (Original): The method of claim 98, further comprising detecting the oxidation state of said storage medium and thereby reading out the data stored therein.

Claim 103 (Original): The method of claim 102, wherein said detecting the oxidation state of the storage medium further comprises refreshing the oxidation state of the storage medium.

Claim 104 (Original): The method of claim 102, wherein said detecting comprises analyzing a readout signal in the time domain.

Claim 105 (Original): The method of claim 102, wherein said detecting comprises analyzing a readout signal in the frequency domain.

Claim 106 (Original): The method of claim 105, wherein said detecting comprises performing a Fourier transform on said readout signal.

Claim 107 (Original): The method of claim 102, wherein said detecting utilizes a voltammetric method.

Claim 108 (Original): The method of claim 102, wherein said detecting utilizes impedance spectroscopy.

Claim 109 (Original): The method of claim 102, wherein said detecting comprises exposing said storage medium to an electric field to produce an electric field oscillation having characteristic frequency and detecting said characteristic frequency.

Claim 110 (Original): The method of claim 98, wherein said storage medium comprises a molecule selected from the group consisting of a porphyrinic macrocycle, a metallocene, a linear polyene, a cyclic polyene, a heteroatom-substituted linear polyene, a heteroatom-substituted cyclic polyene, a tetrathiafulvalene, a tetraselenafulvalene, a metal coordination complex, a buckyball, a triarylamine, a 1,4-phenylenediamine, a xanthene, a flavin, a phenazine, a phenothiazine, an acridine, a quinoline, a 2,2'-bipyridyl, a 4,4'-bipyridyl, a tetrathiotetracene, and a *peri*-bridged naphthalene dichalcogenide.

Claim 111 (Original): The method of claim 110, wherein said storage medium comprises a molecule selected from the group consisting of a porphyrin, an expanded porphyrin, a contracted porphyrin, a ferrocene, a linear porphyrin polymer, and a porphyrin array.

Claim 112 (Original): The method of claim 110, wherein said storage medium comprises a porphyrinic macrocycle substituted at a β- position or at a *meso-* position.

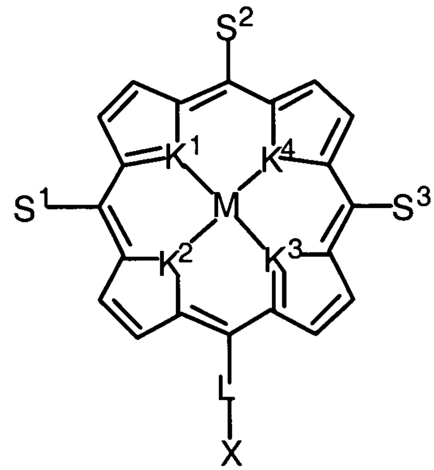
Claim 113 (Original): The method of claim 110, wherein said molecule has at least eight different and distinguishable oxidation states.

Claim 114 (Original): In a computer system, a memory device, said memory device comprising the apparatus of claim 1.

Claim 115 (Original): A computer system comprising a central processing unit, a display, a selector device, and a memory device, said memory device comprising the apparatus of claim 1.

Claim 116 (Original): An apparatus for storing data, said apparatus comprising:

a fixed electrode electrically coupled to a storage medium comprising a storage molecule having the formula:



wherein

K^1, K^2, K^3, and K^4 are independently selected from the group consisting of N, O, S, Se, Te, and CH;

M is a metal or (H,H);

S^1, S^2, and S^3 are indepently selected from the group consisting of aryl, phenyl, cycloalkyl, alkyl, alkoxy, halogen, alkylthio, alkoxy, perfluoroalkyl, perfluoroaryl, pyidyl, nitrile, nitro, amino, and alkylamino;

L is present or absent and, when present, is a linker; and

X is a substrate or a reactive site that can covalently or ionically couple to a substrate.

Claim 117 (Original): The apparatus of claim 116, wherein said storage medium stores data at a density of at least one bit per molecule.

Claim 118 (Original): The apparatus of claim 116, wherein said storage medium has at least two different and distinguishable non-neutral oxidation states.

Claim 119 (Original): The apparatus of claim 116, wherein said storage medium has at least eight different and distinguishable oxidation states.

Claim 120 (Original): The apparatus of claim 116, wherein said storage molecule is covalently linked to said electrode.

Claim 121 (Original): The apparatus of claim 116, wherein said storage molecule is electrically coupled to said electrode through a linker.

Claim 122 (Original): The apparatus of claim 116, wherein said storage molecule is covalently linked to said electrode through a linker.

Claim 123 (Original): The apparatus of claim 7, wherein said linker is a thiol linker.

Claim 124 (Original): The apparatus of claim 116, wherein said storage medium is juxtaposed in the proximity of said electrode such that electrons can pass from said storage medium to said electrode.

Claim 125 (Original): The apparatus of claim 116, wherein said storage medium is juxtaposed to a dielectric material imbedded with counterions.

Claim 126 (Original): The apparatus of claim 116, wherein said storage medium and said electrode are fully encapsulated in an integrated circuit.

Claim 127 (Original): The apparatus of claim 116, wherein said storage medium is electronically coupled to a second fixed electrode that is a reference electrode.

Claim 128 (Original): The apparatus of claim 116, wherein said storage medium is present on a single plane in said device.

Claim 129 (Original): The apparatus of claim 116, wherein said storage medium is present at a multiplicity of storage locations.

Claim 130 (Original): The apparatus of claim 14, wherein said storage locations are present on a single plane in said device.

Claim 131 (Original): The apparatus of claim 14, wherein said apparatus comprises multiple planes and said storage locations are present on multiple planes of said device.

Claim 132 (Original): The apparatus of claim 14, wherein said storage locations range from about 1024 to about 4096 different locations.

Claim 133 (Original): The apparatus of claim 17, wherein each location is addressed by a single electrode.

Claim 134 (Original): The apparatus of claim 17, wherein each location is addressed by two electrodes.

Claim 135 (Original): The apparatus of claim 116, wherein said electrode is connected to a voltage source.

Claim 136 (Original): The apparatus of claim 20, wherein said voltage source is the output of an integrated circuit.

Claim 137 (Original): The apparatus of claim 116, wherein said electrode is connected to a device to read the oxidation state of said storage medium.

Claim 138 (Original): The apparatus of claim 22, wherein said device is selected from the group consisting of a voltammetric device, an amperometric device, and a potentiometric device.

Claim 139 (Original): The apparatus of claim 23, wherein said device is an impedance spectrometer or a sinusoidal voltammeter.

Claim 140 (Original): The apparatus of claim 22, wherein said device provides a Fourier transform of the output signal from said electrode.

Claim 141 (Original): The apparatus of claim 22, wherein said device refreshes the oxidation state of said storage medium after reading said oxidation state.

Claim 142 (Original): The apparatus of claim 116, wherein said different and distinguishable oxidation states of said storage medium can be set by a voltage difference no greater than about 2 volts.

Claim 143 (Original): The apparatus of claim 116, wherein M is selected from the group consisting of Zn, Mg, Cd, Hg, Cu, Ag, Au, Ni, Pd, Pt, Co, Rh, Ir, Mn, B, Al, Pb, Ga, and Sn.

Claim 144 (Original): The apparatus of claim 116, wherein M is selected from the group consisting of Zn, Mg, and (H,H).

Claim 145 (Original): The apparatus of claim 116, wherein S is selected from the group consisting of mesityl, C_6F_5, 2,4,6-trimethoxyphenyl, and *n*-pentyl.

Claim 146 (Original): The apparatus of claim 116, wherein X is selected from the group consisting of CONH(Et), $COCH_3$, and H.

Claim 147 (Original): The apparatus of claim 116, wherein L-X is selected from the group consisting of 4-(2-(4-mercaptophenyl)ethynyl)phenyl, 4-mercaptomethylphenyl, 4-hydroselenophenyl, 4-(2-(4-hydroselenophenyl)ethynyl)phenyl, 4-hydrotellurophenyl, and 4-(2-(4-hydrotellurophenyl)ethynyl)phenyl.

Claim 148 (Original): The apparatus of claim 116, wherein

S^1, S^2, and S^3 are all the same;

K^1, K^2, K^3, and K^4 are all N; and

L is p-thiophenyl.

Claim 149 (Original): The apparatus of claim 148, wherein M is Zn or (H,H).

Claim 150 (Original): The apparatus of claim 149, wherein S^1, S^2, and S^3 are selected from the group consisting of mesityl, C_6F_5, 2,4,6-trimethoxyphenyl, and *n*-pentyl.

Claim 151 (Currently Amended): The apparatus of claim 149, wherein X is selected from the group consisting of CONH(Et), $COCH_3$, and H.

Claims 152-231 (Canceled).

Claim 232 (Previously presented): A method of storing data, said method comprising:

i) providing an apparatus according to claims 1 or 116; and

ii) applying a voltage to said electrode at sufficient current to set an oxidation state of said storage medium.

Claim 233 (Original): The method of claim 232, wherein said voltage ranges up to about 2 volts.

Claim 234 (Original): The method of claim 232, wherein said voltage is the output of an integrated circuit.

Claim 235 (Original): The method of claim 232, wherein said voltage is the output of a logic gate.

Claim 236 (Original): The method of claim 232, further comprising detecting the oxidation state of said storage medium and thereby reading out the data stored therein.

Claim 237 (Original): The method of claim 236, wherein said detecting the oxidation state of the storage medium further comprises refreshing the oxidation state of the storage medium.

Claim 238 (Original): The method of claim 236, wherein said detecting comprises analyzing a readout signal in the time domain.

Claim 239 (Original): The method of claim 236, wherein said detecting comprises analyzing a readout signal in the frequency domain.

Claim 240 (Original): The method of claim 239, wherein said detecting comprises performing a Fourier transform on said readout signal.

Claim 241 (Original): The method of claim 236, wherein said detecting utilizes a voltammetric method.

Claim 242-243 (Canceled)..